Predicted Grizzly Bear Habitat in the Bitterroot Ecosystem

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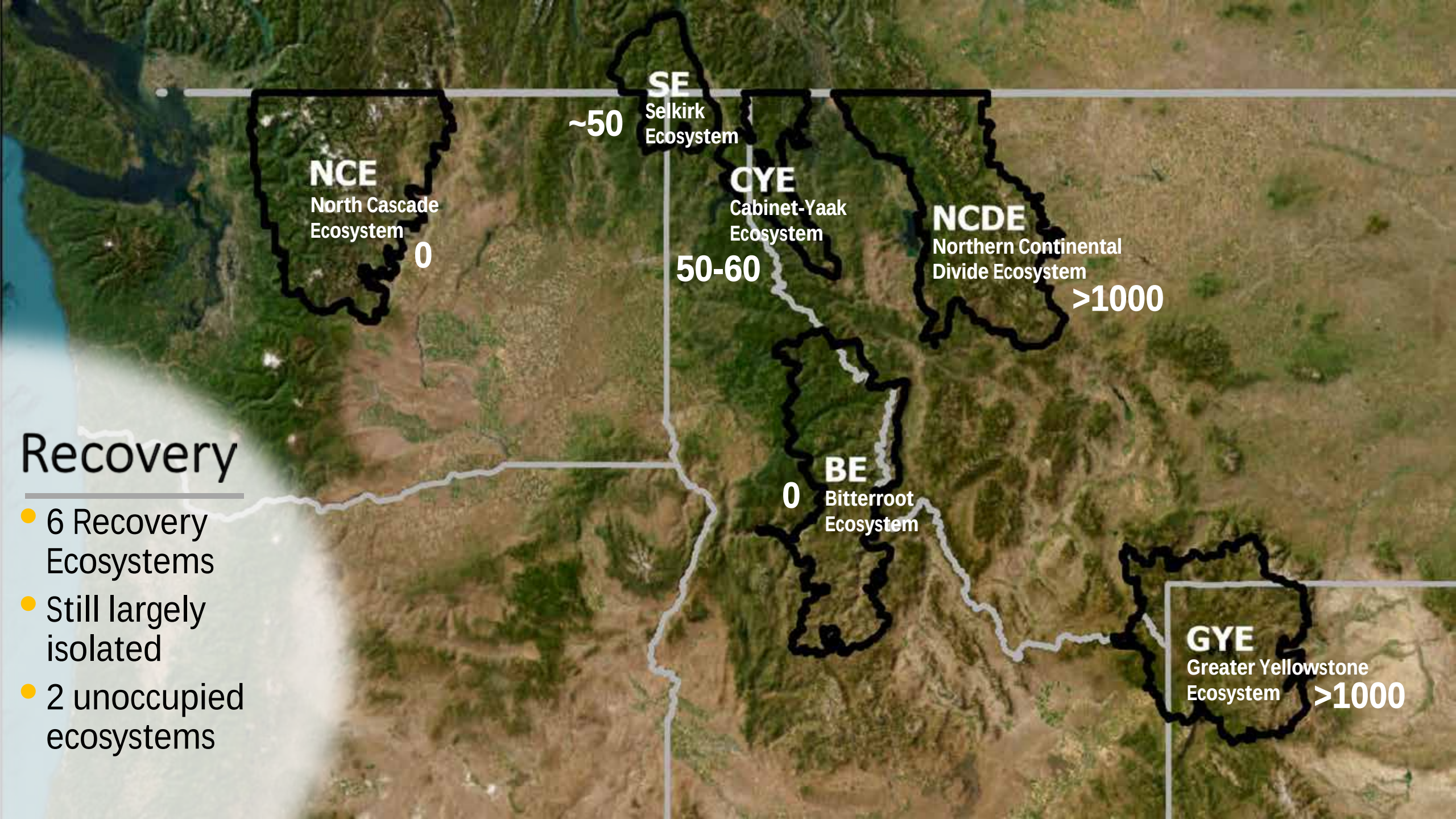
Photo: G. Smith


SE
Selkirk
Ecosystem
~50
NCE
North Cascade
Ecosystem
0
CYE
Cabinet-Yaak
Ecosystem
50-60
NCDE
Northern Continental
Divide Ecosystem
>1000
BE
Bitterroot
Ecosystem
0
GYE
Greater Yellowstone
Ecosystem
>1000
Recovery
6 Recovery Ecosystems
Still largely isolated
2 unoccupied ecosystems

Motivation

- **Understand spatial behavior**
  - Habitat use
  - Range expansion
  - Potential for connectivity

Jim Peaco

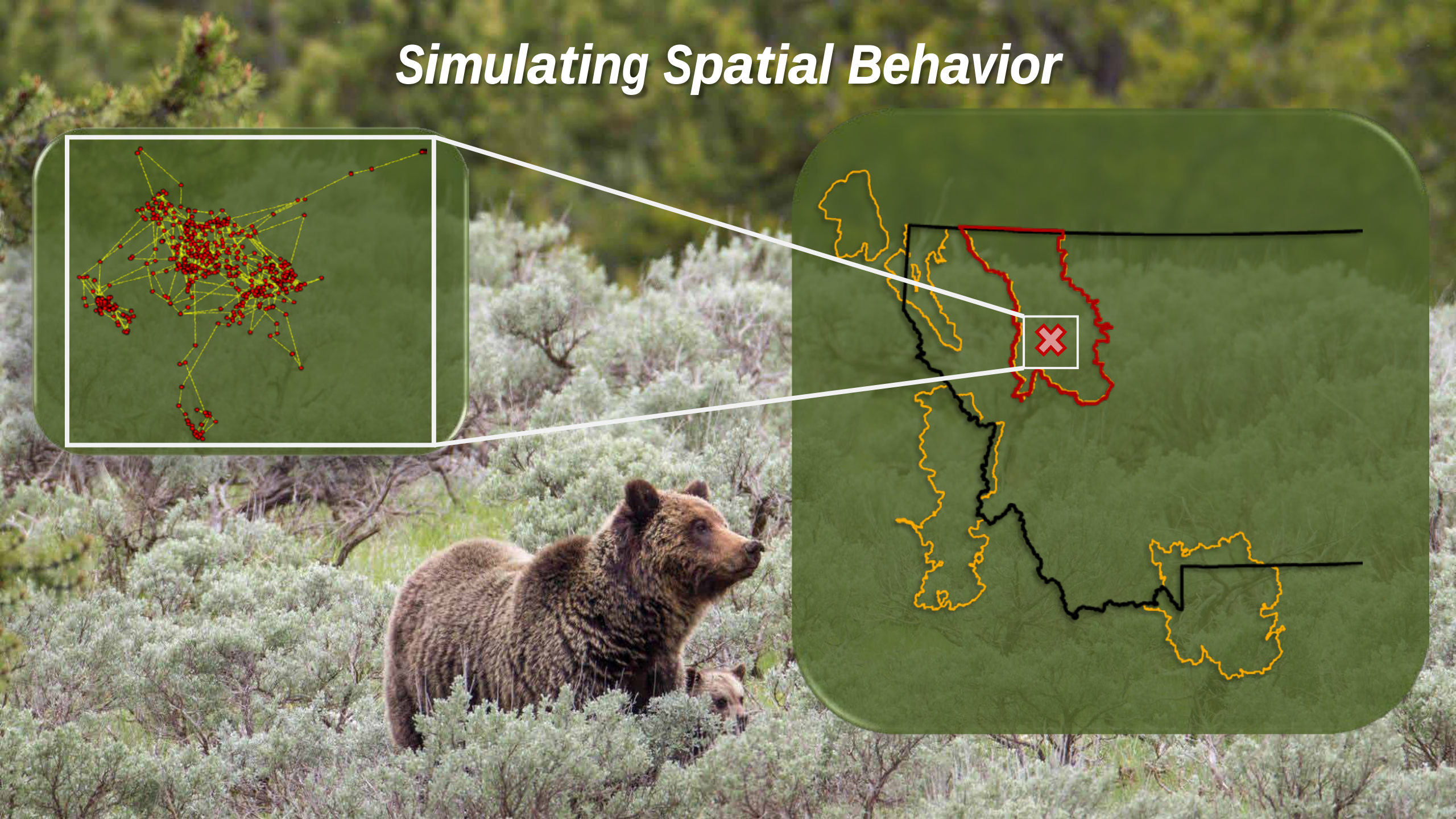
Movement Models

- Integrated step selection functions (iSSFs)
  - NCDE bears
    - 2003 – 2021
    - May – Nov
  - Model for each individual
    - 46 females
    - 19 males

Simulating Spatial Behavior

- Simulate movements

Simulating Spatial Behavior



Simulating Spatial Behavior

- Simulate movements
- Summarize results
  - # of steps/cell à 10 quantile classes
    - 1 = low use
    - 10 = high use

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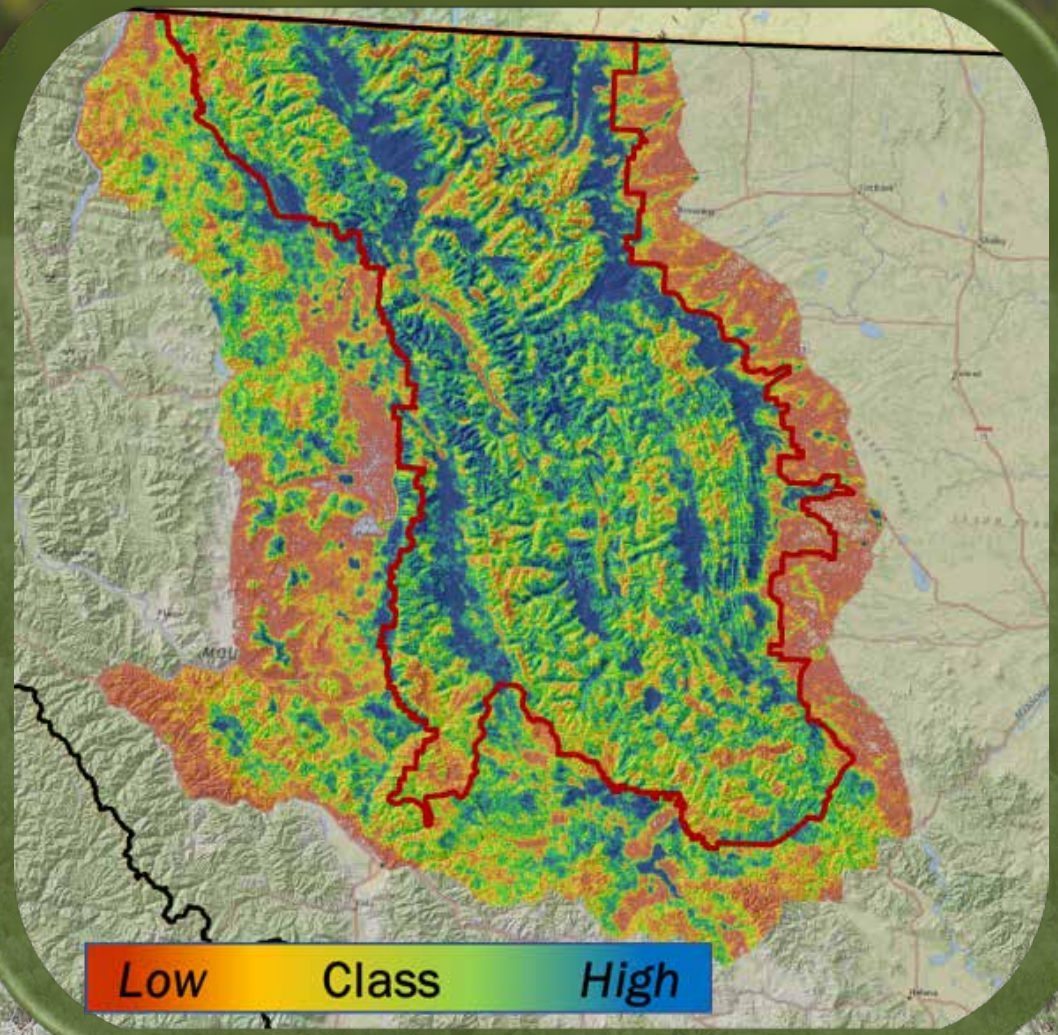
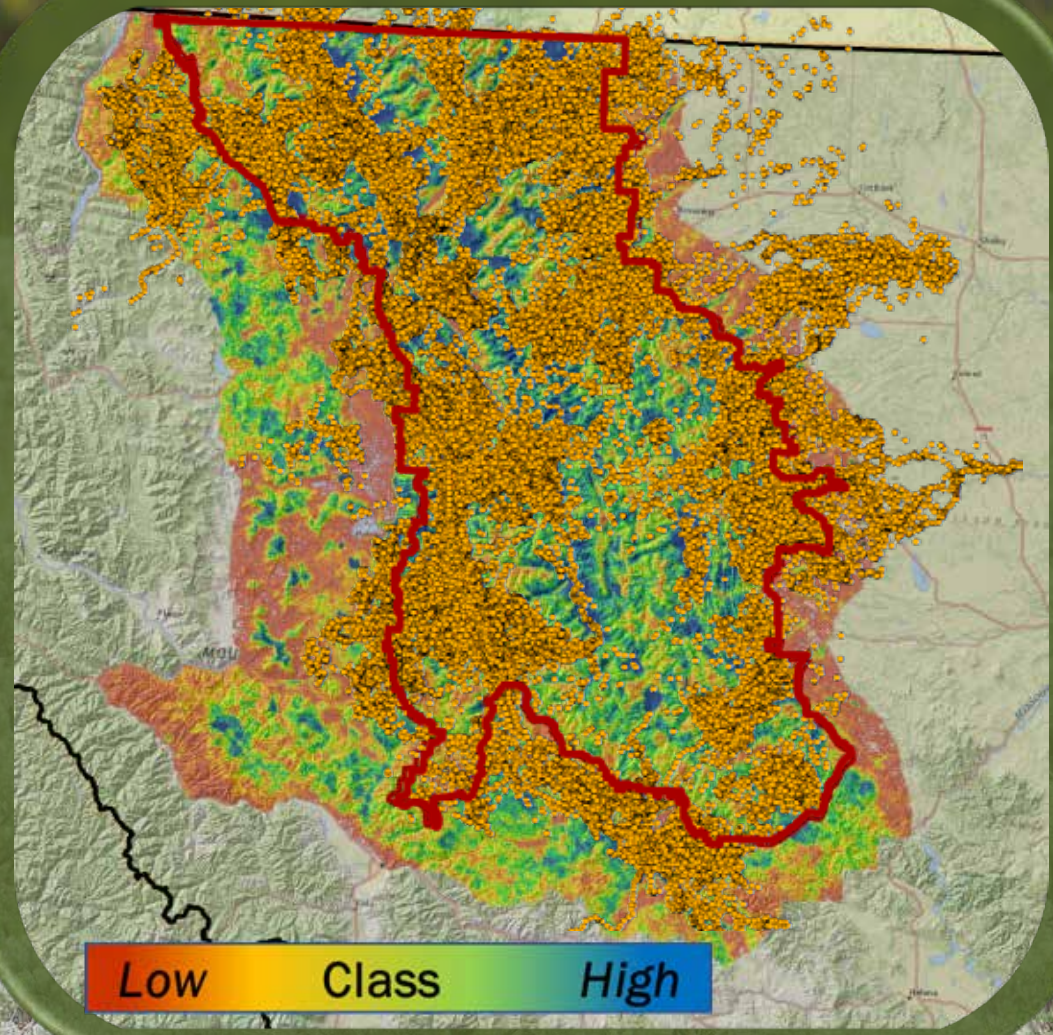


Assessing Predictions

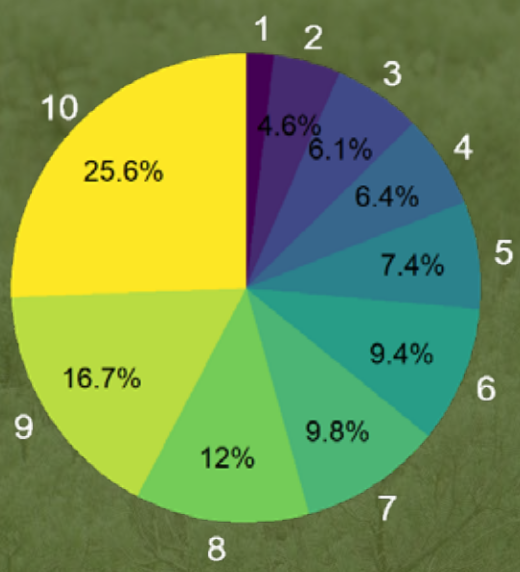
- Overlay locations
  - 2003 – 2021
  - 165 females
  - 97 males
  - >377,000 fixes
- Summarize performance



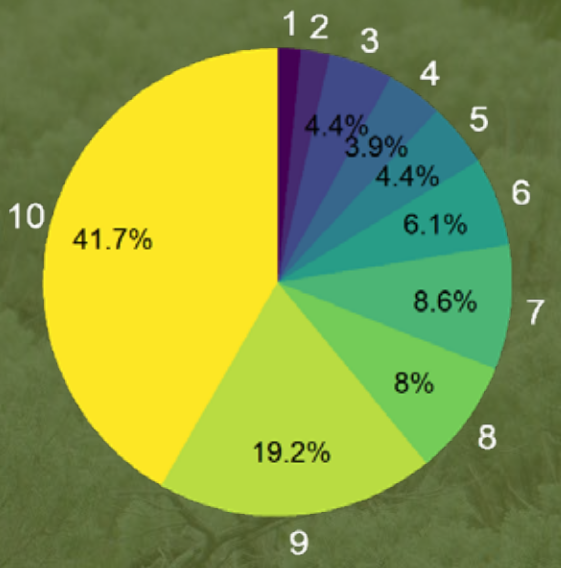
Assessing Predictions

% fixes per class

Females:



Males:



à **Highly predictive across season & years**

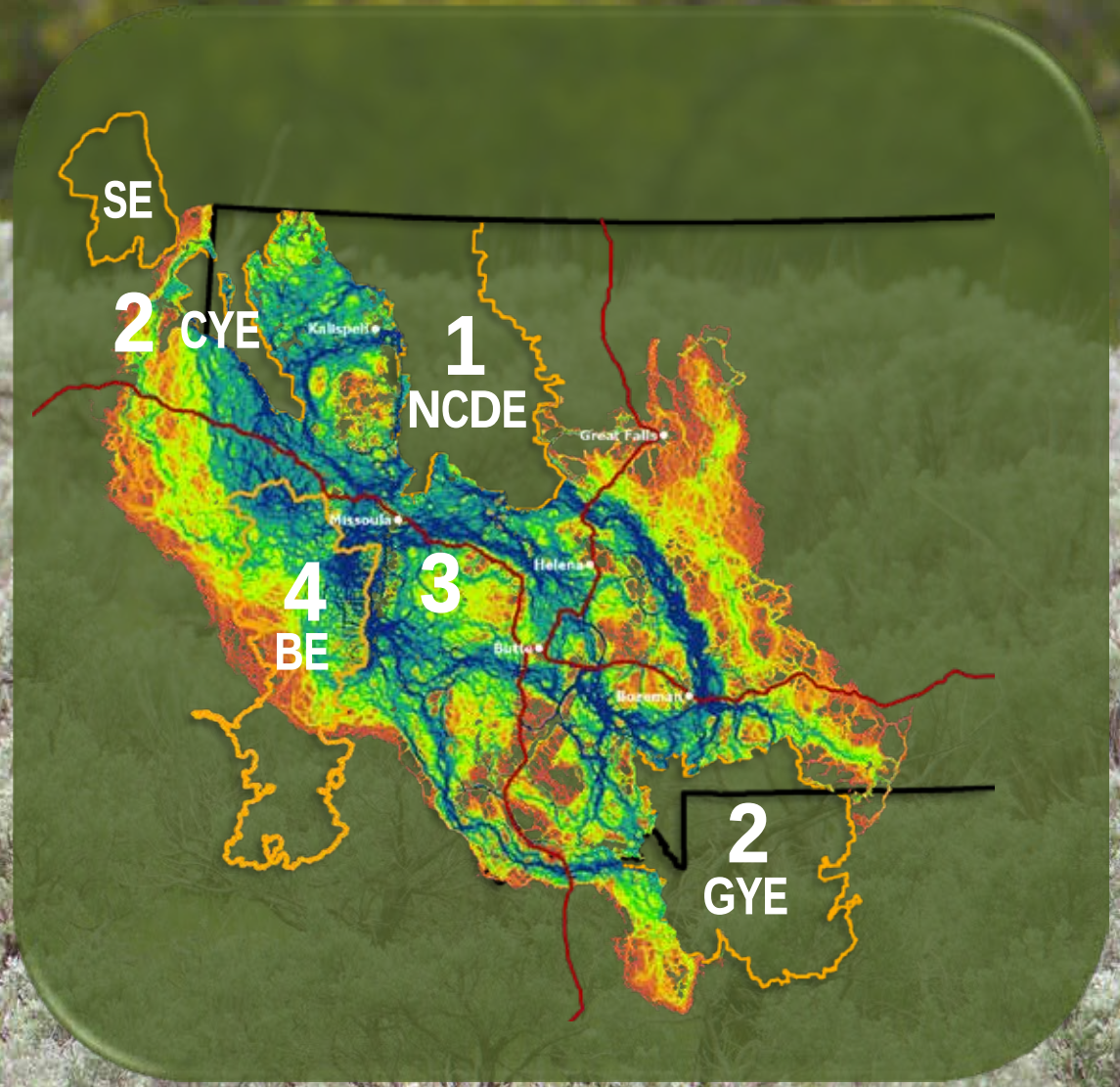
Multi-Phased Approach

Phase 1: develop models, simulate for NCDE, test predictive power

Phase 2: apply models to GYE, SE, and CYE; test transferability

Phase 3: apply models between populations; predict connectivity pathways

Phase 4: apply models to Bitterroot Ecosystem

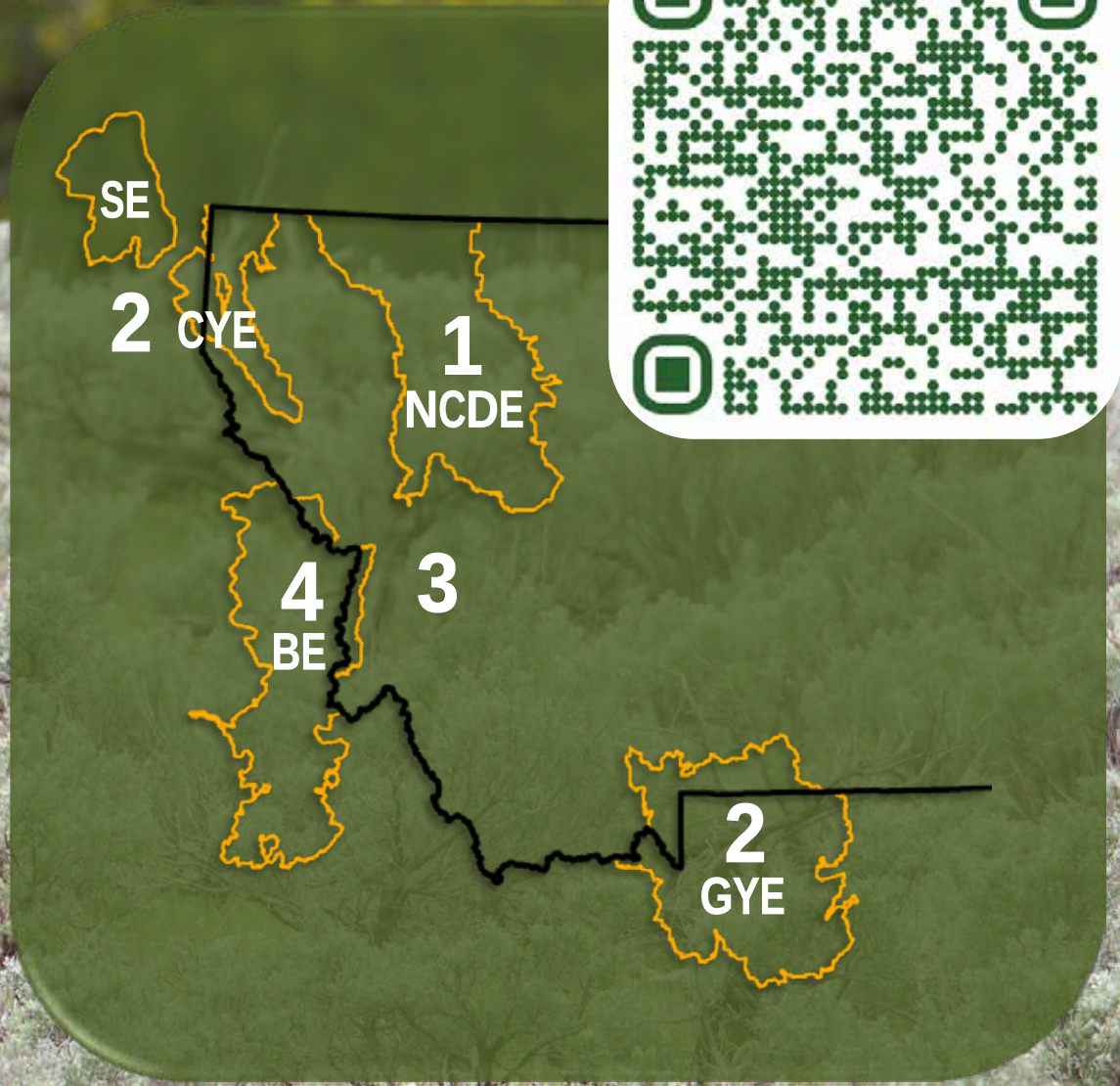


Multi-Phased Approach

Phase 1: Sells et al. 2022. Grizzly bear habitat selection across the Northern Continental Divide Ecosystem.

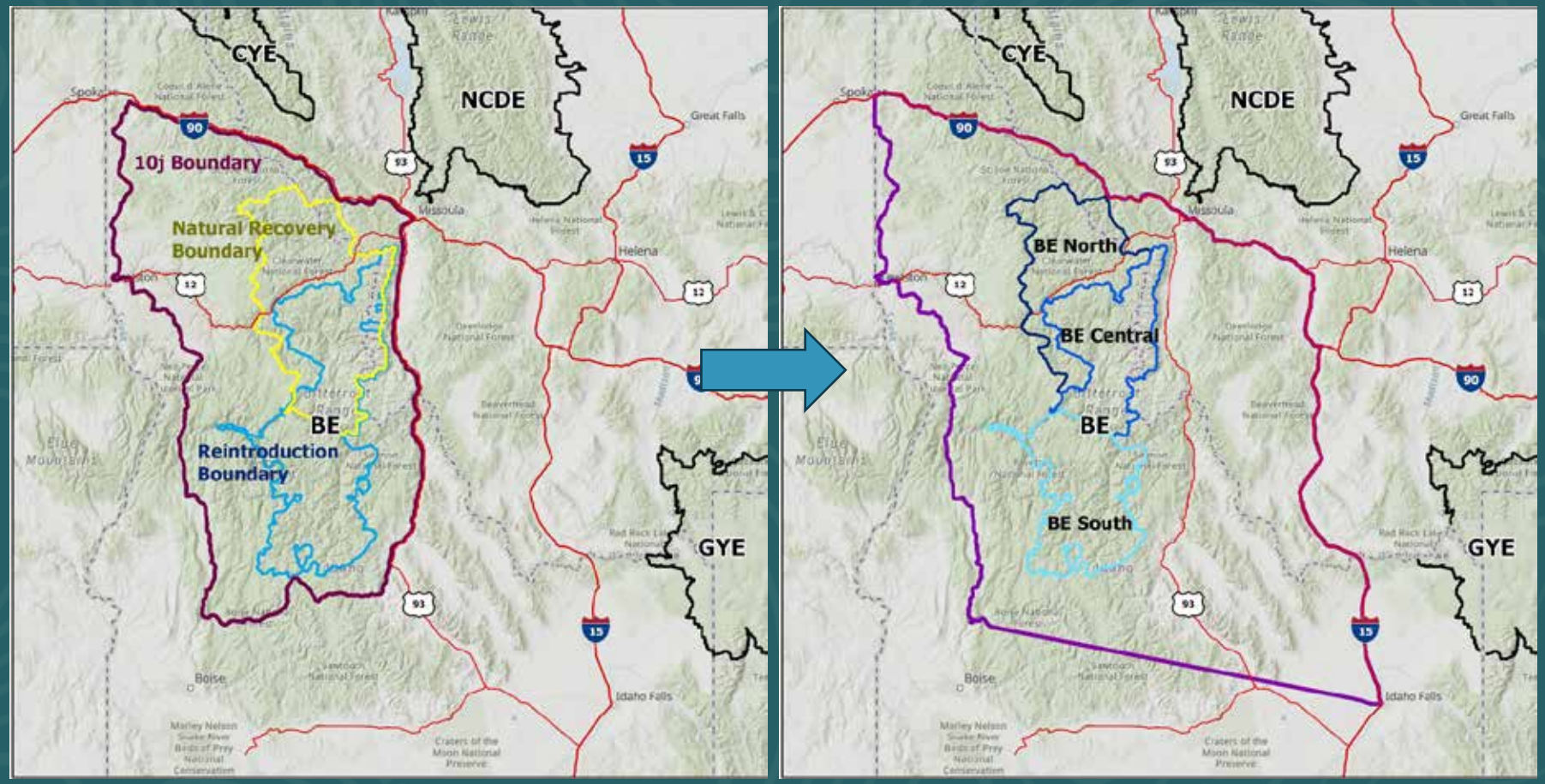
Phase 2: Sells et al. 2023. Grizzly bear movement models predict habitat use for nearby populations.

Phase 3: Sells et al. 2023. Predicted connectivity pathways between grizzly bear ecosystems in Western Montana.



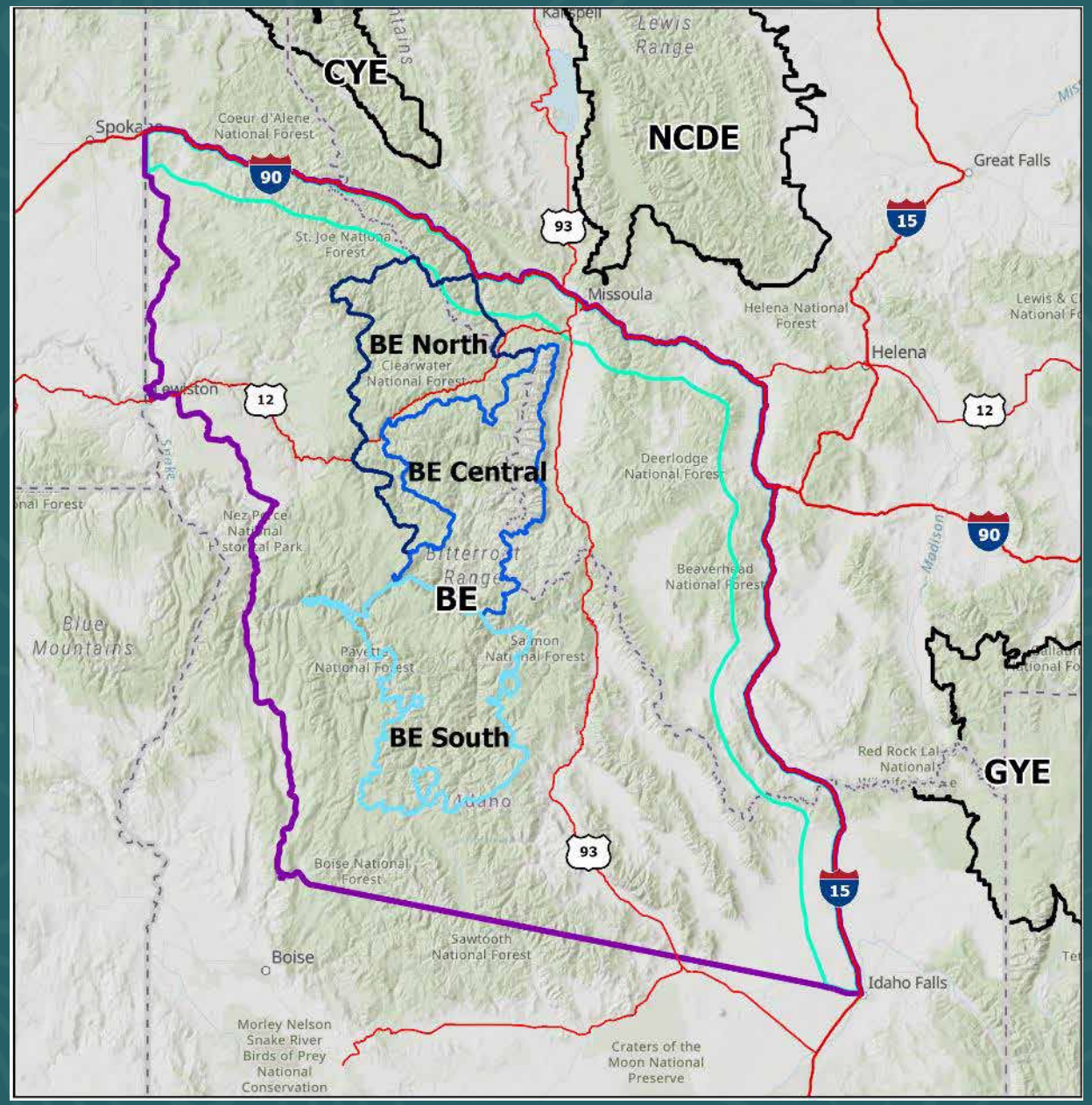
Model Application: Phase 4

- **Goal: predict habitat use**
  - Natural recovery
  - Reintroduction
- **Study area**
  - Based on 10j boundary from 2000 ROD

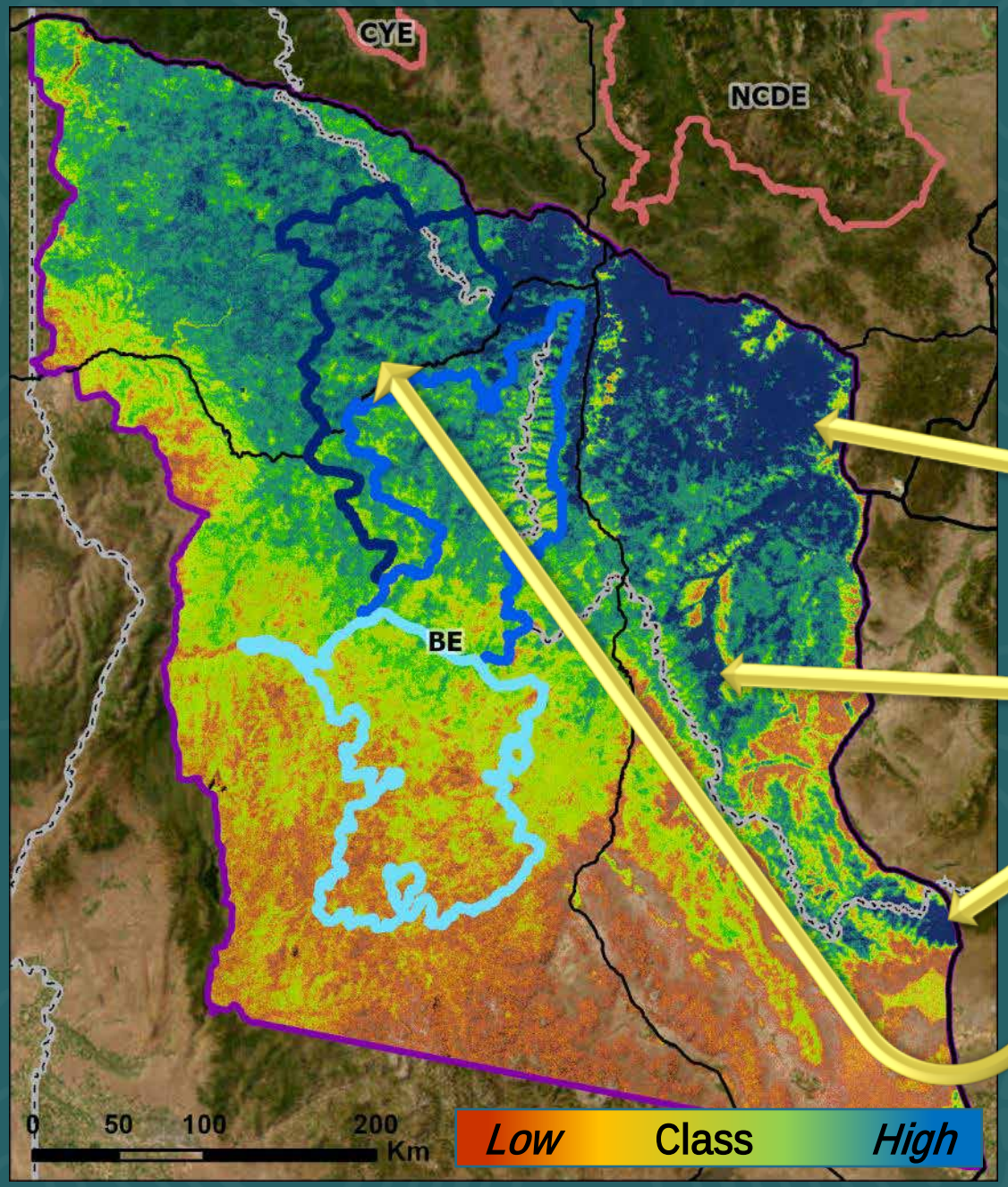


Model Application: Phase 4

- **First set of simulations:**
  - Natural recolonization
    - Start zone: near I-90 & I-15



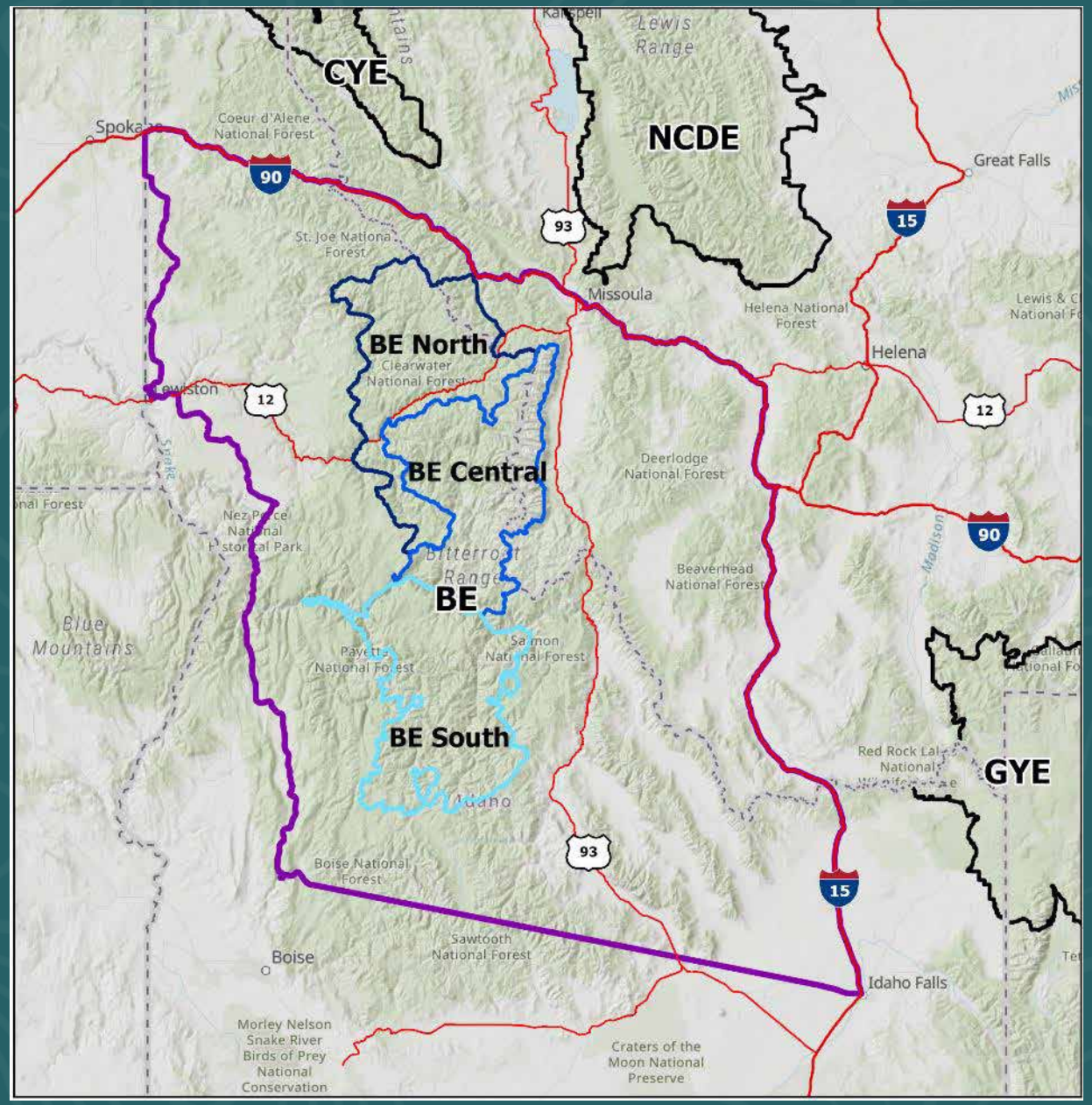
Natural Recolonization



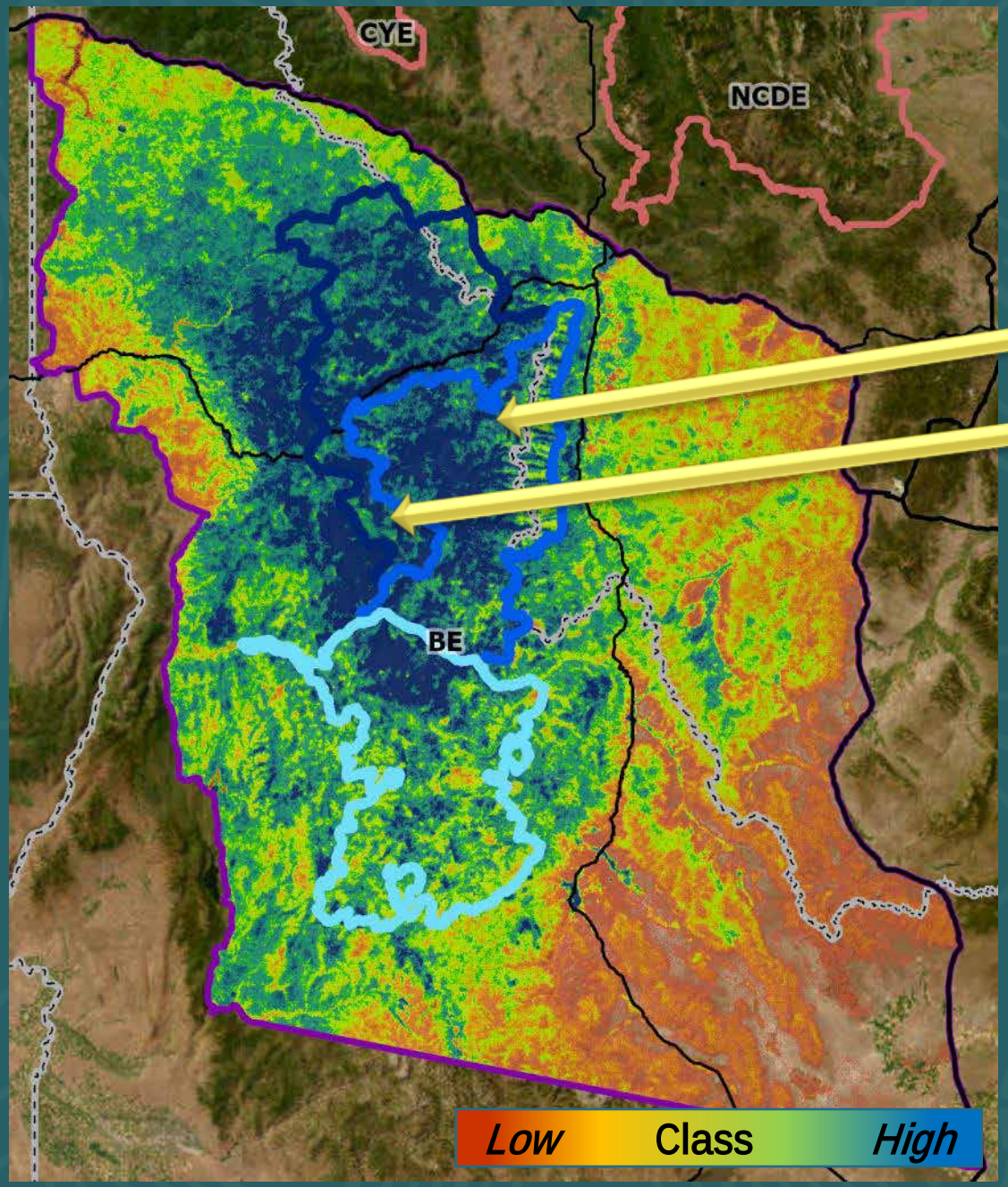
- Northeast corner
  - Sapphire Mountains
  - John Long Mountains
  - Flint Creek Range
  - Anaconda Range
  - Big Hole Valley
- Centennial à Beaverhead Mountains
- BE North

Model Application: Phase 4

- **Second set of simulations:**
  - Reintroduction
    - Start zone: BE (North, Central, & South)

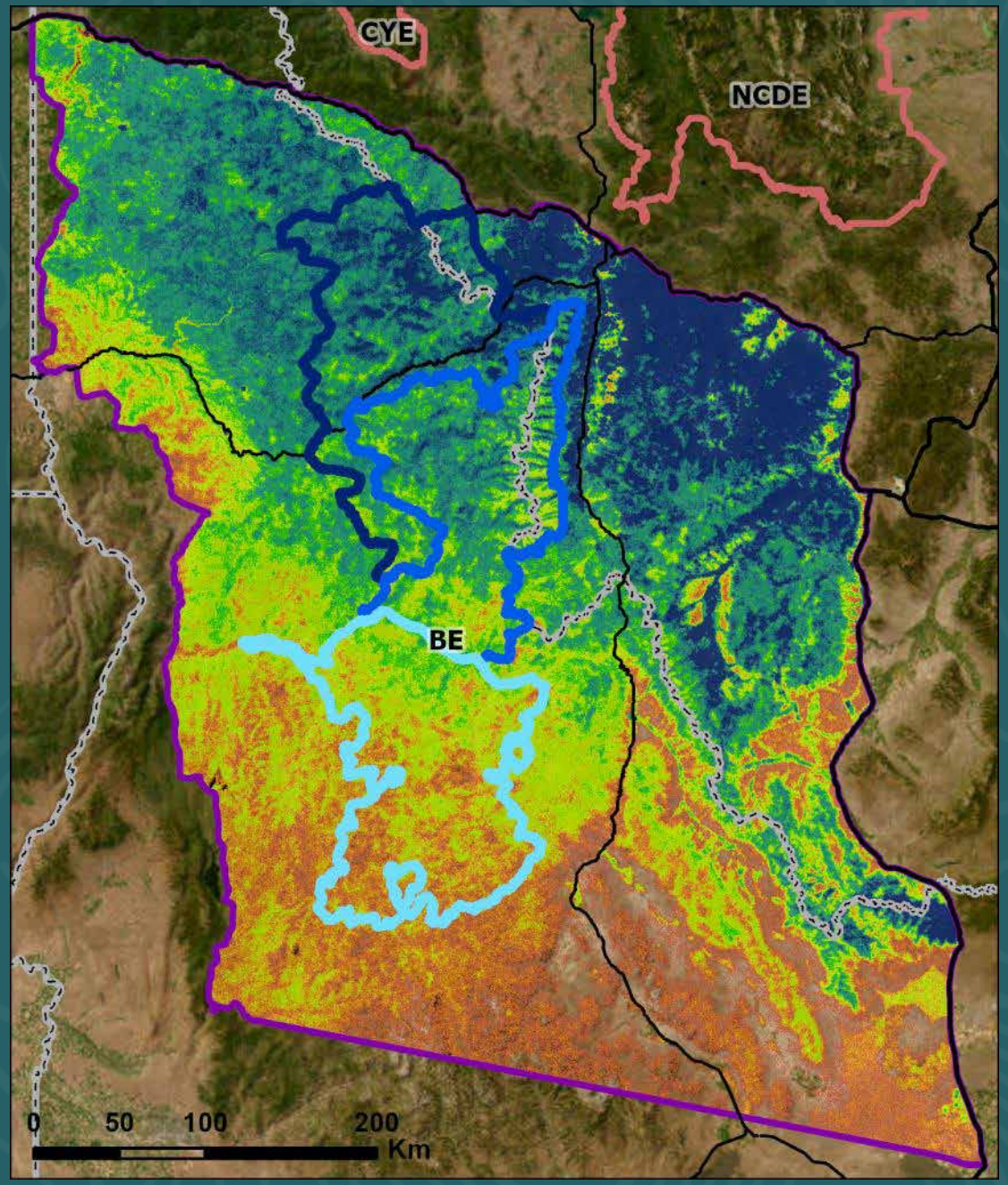


Reintroduction

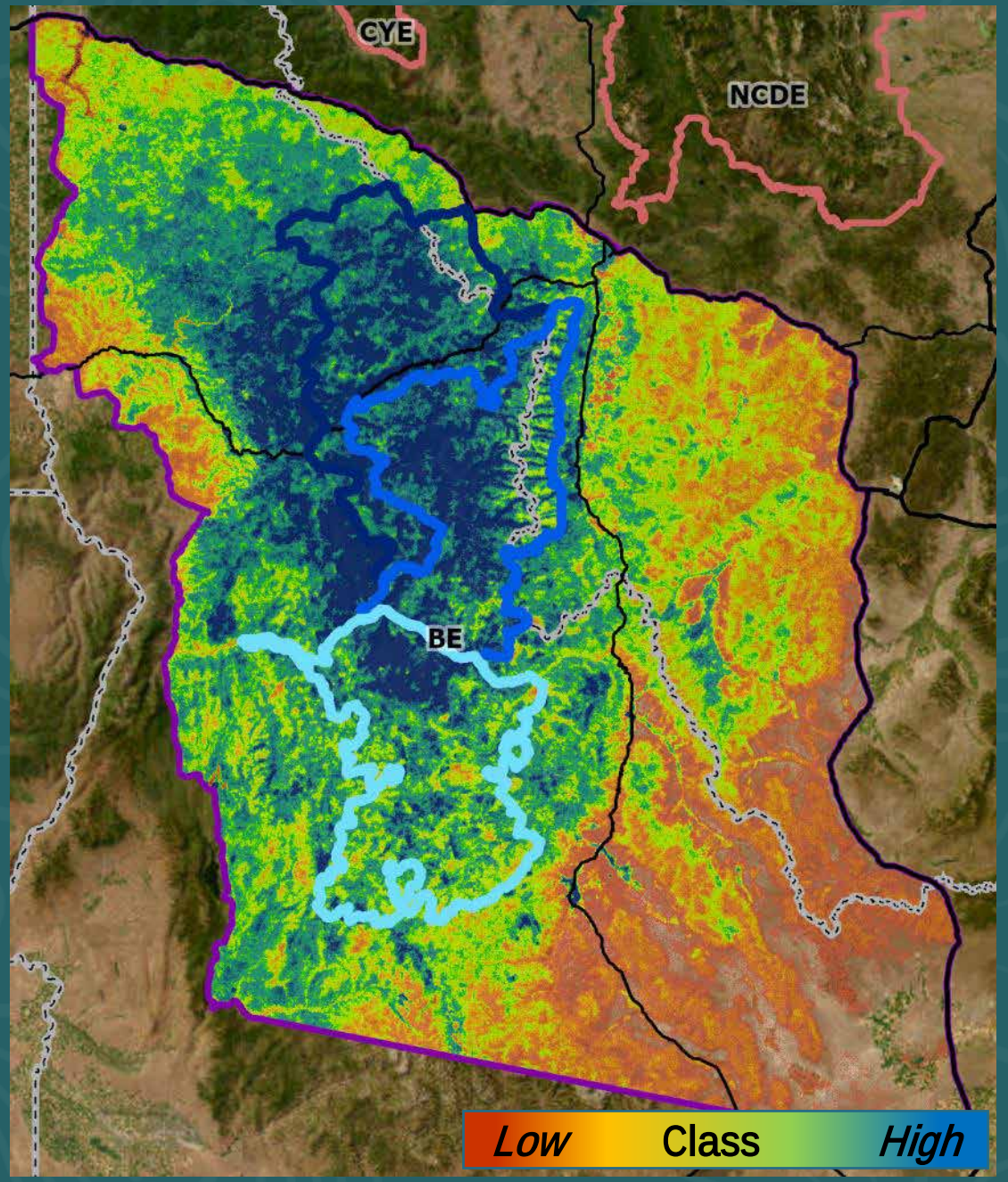


- BE North & Central
  - Bitterroot Mountains
  - Clearwater Mountains

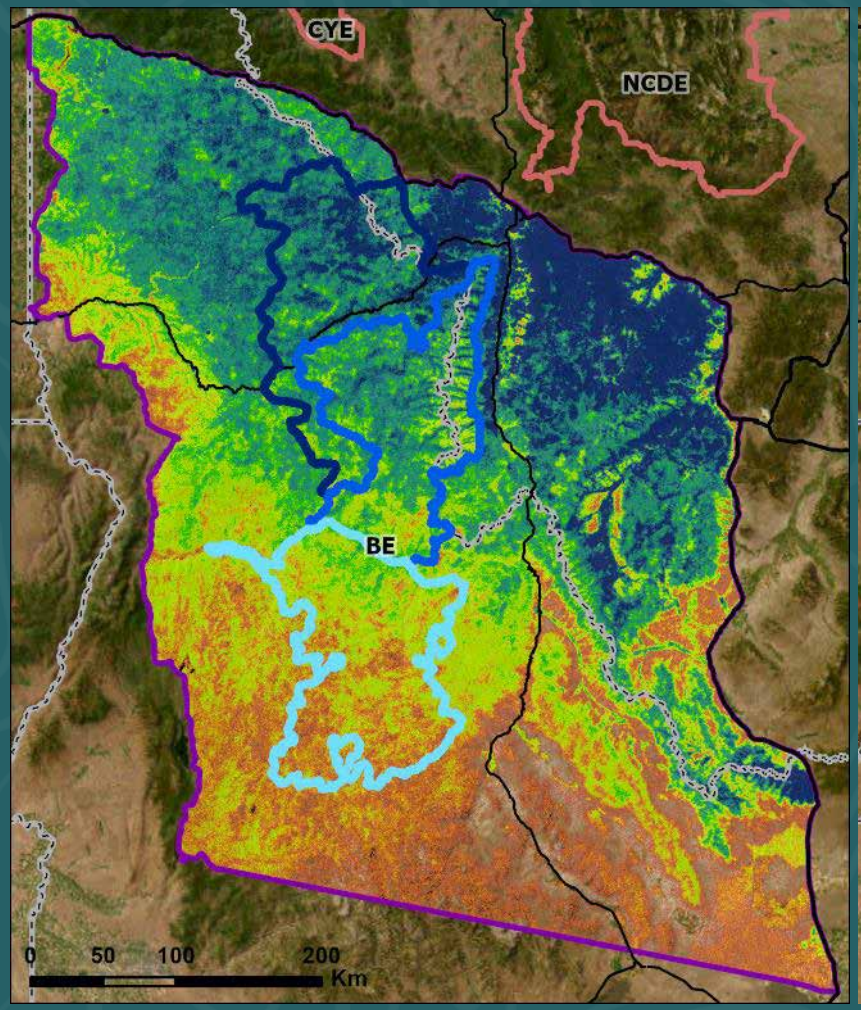
Natural Recolonization



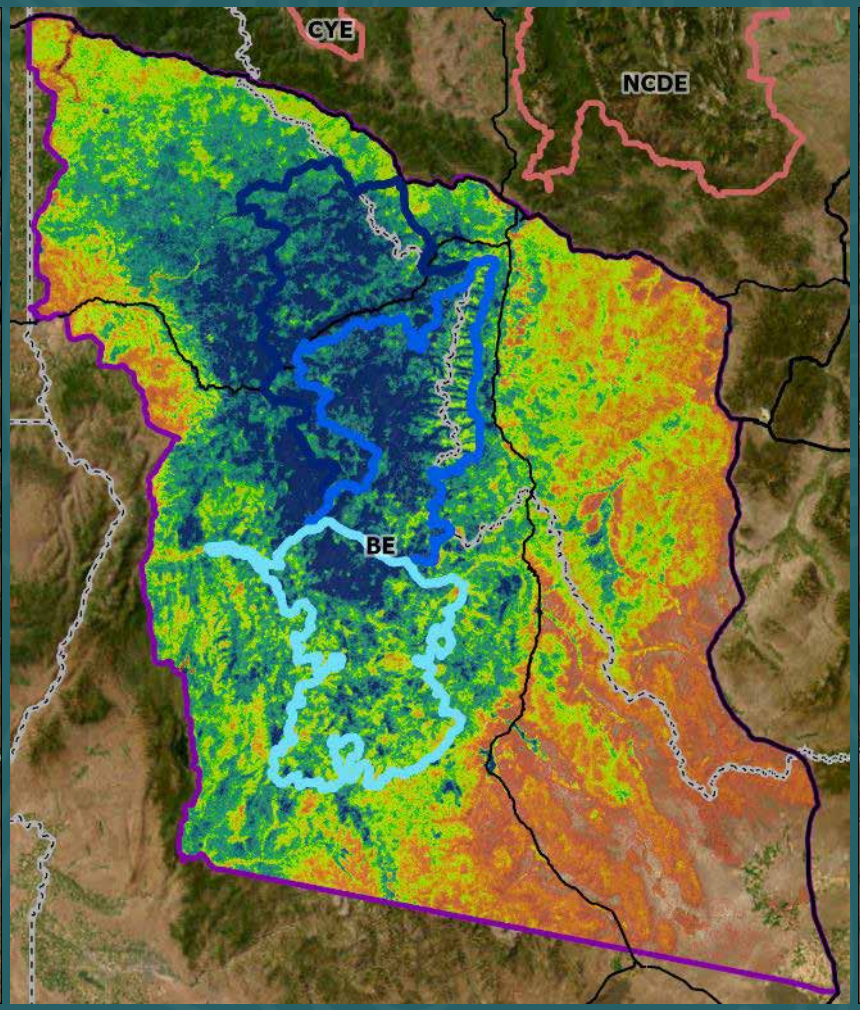
Reintroduction



Natural Recolonization



Reintroduction



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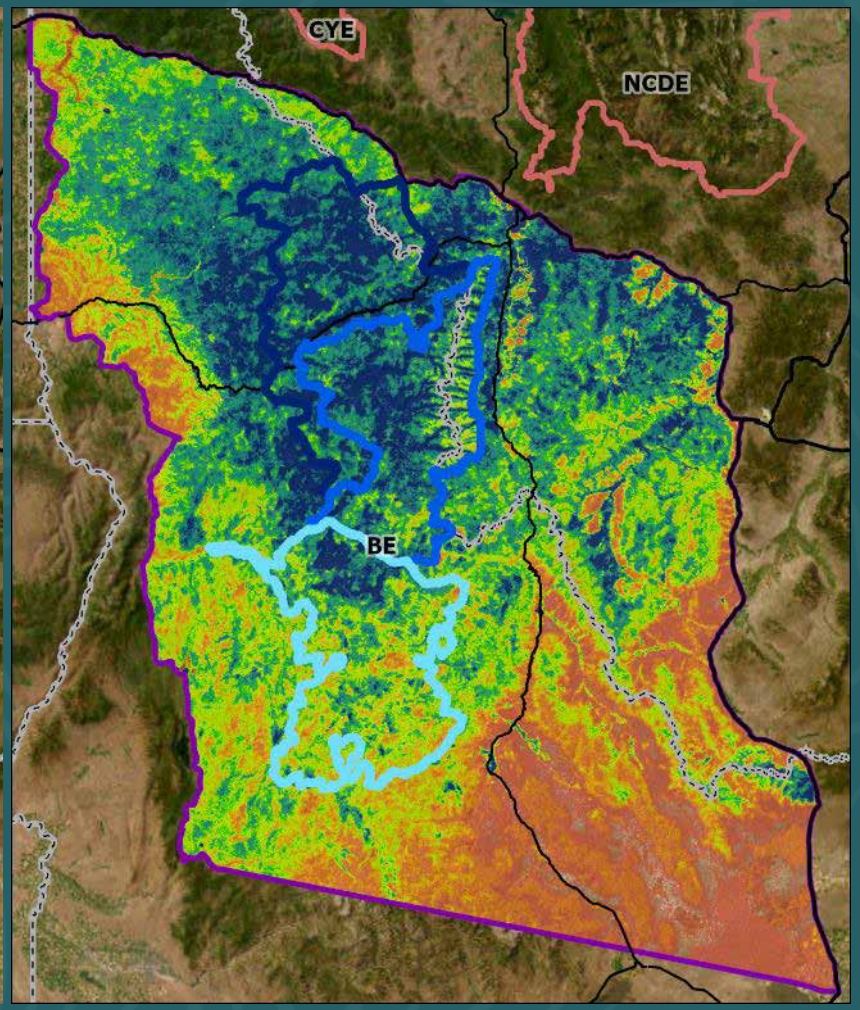
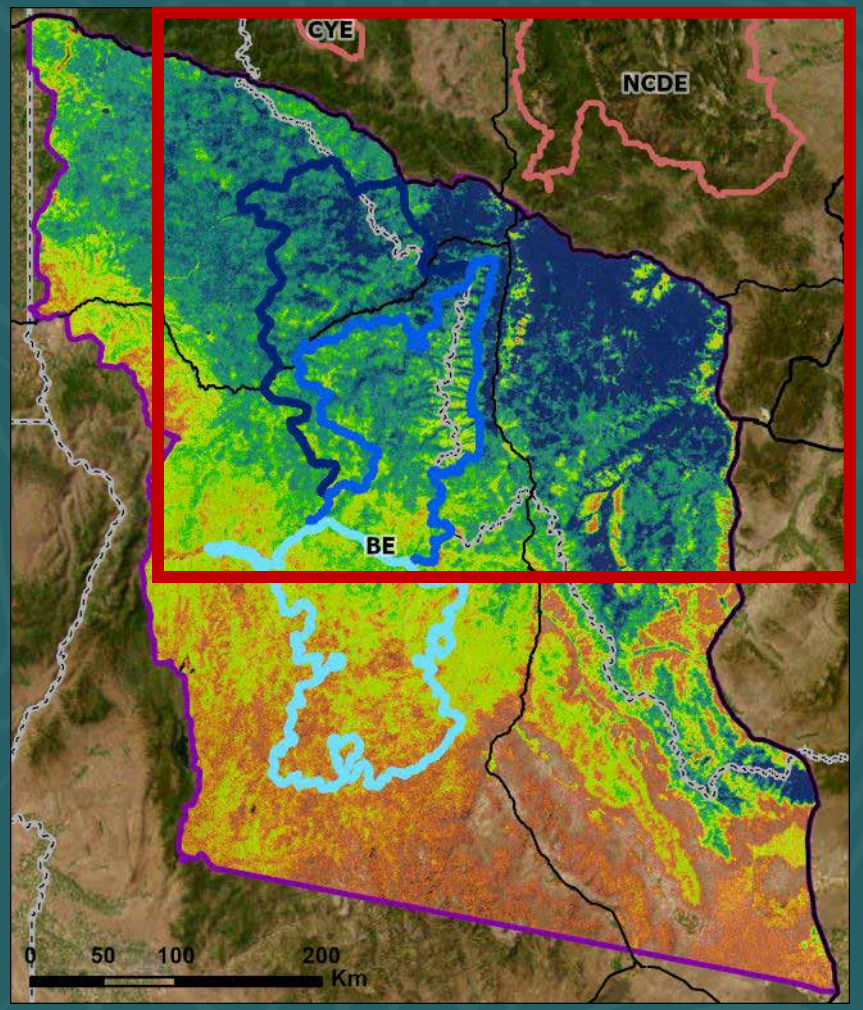
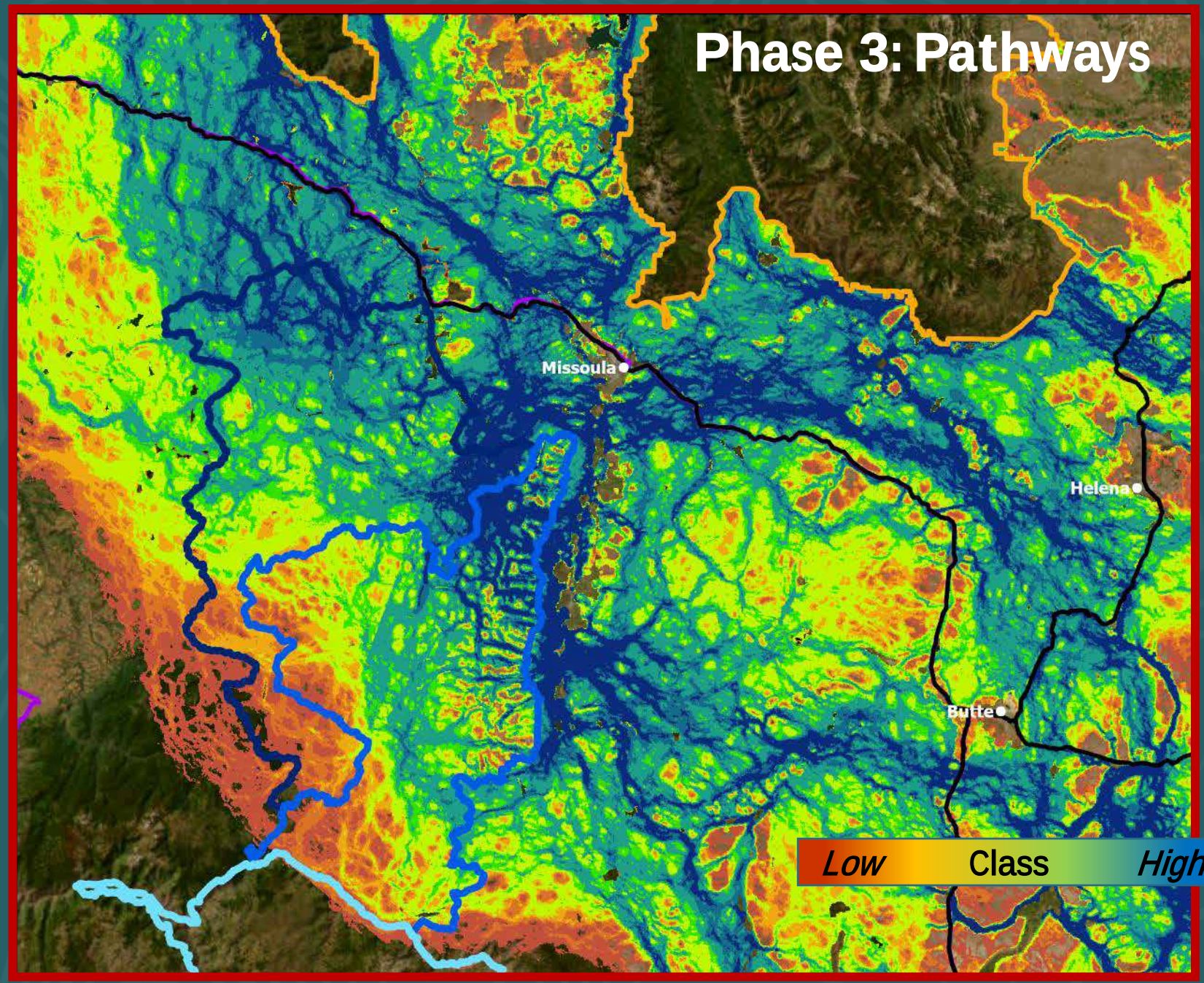


Low Class *High*

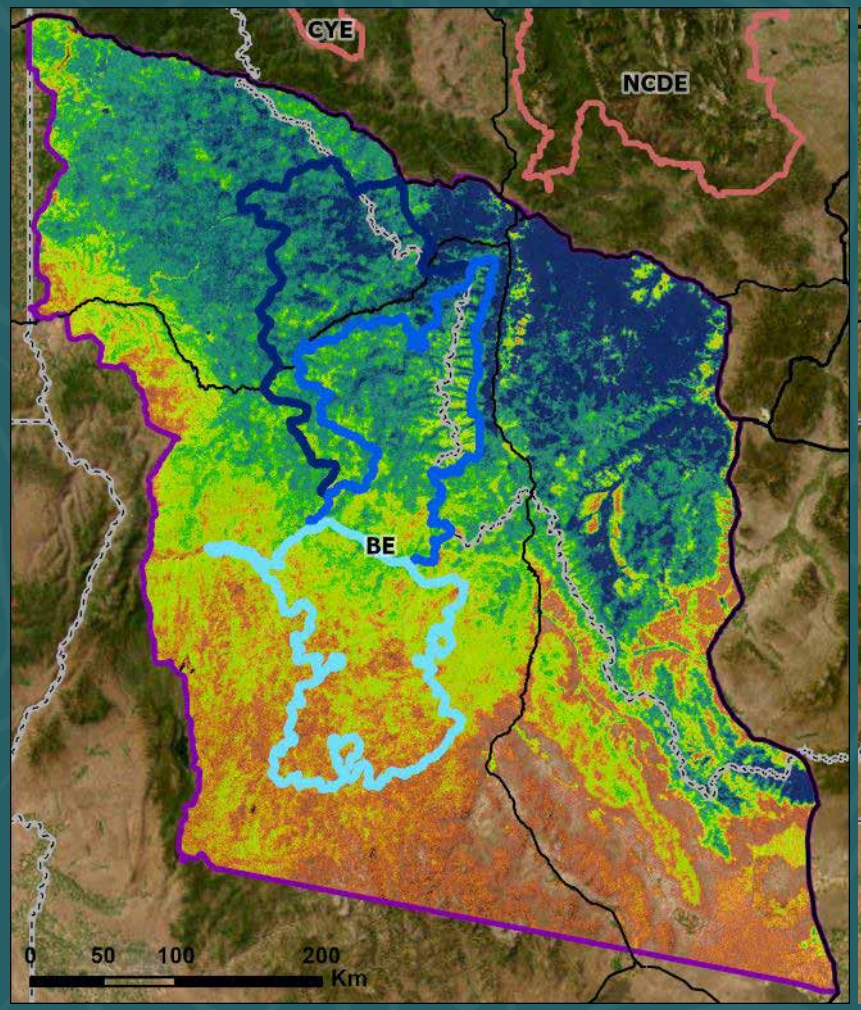
Natural Recolonization



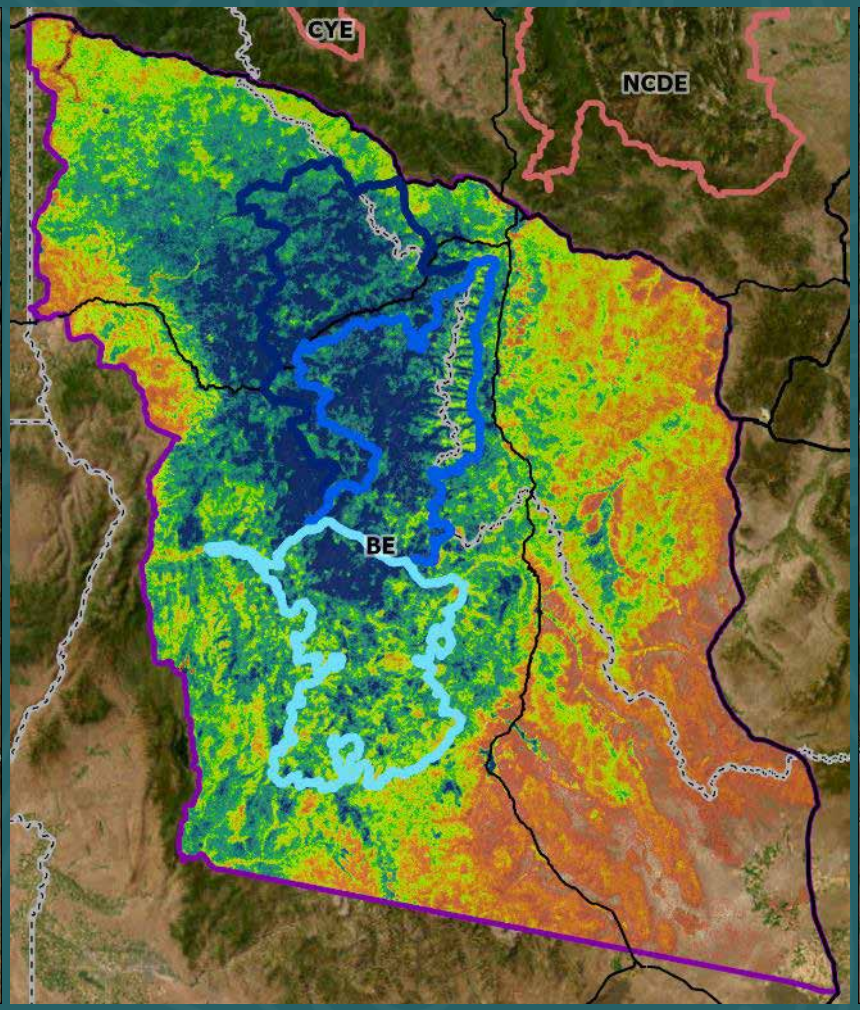
Phase 3: Pathways



Natural Recolonization



Reintroduction



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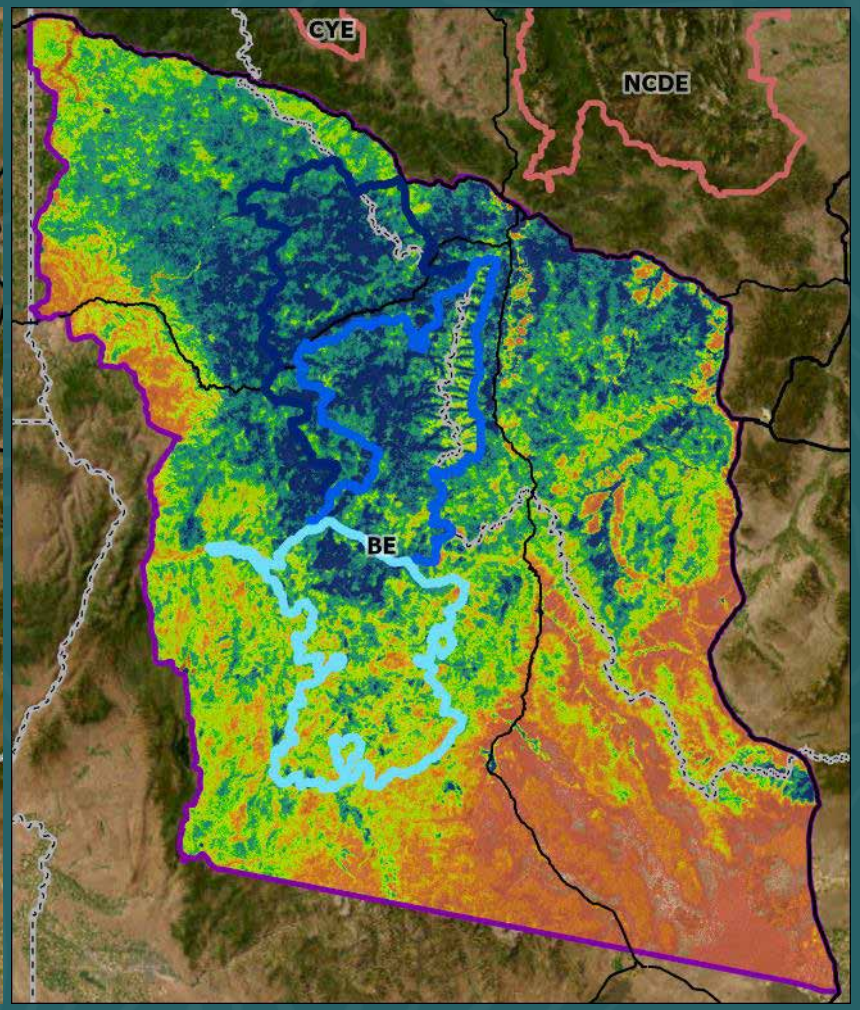
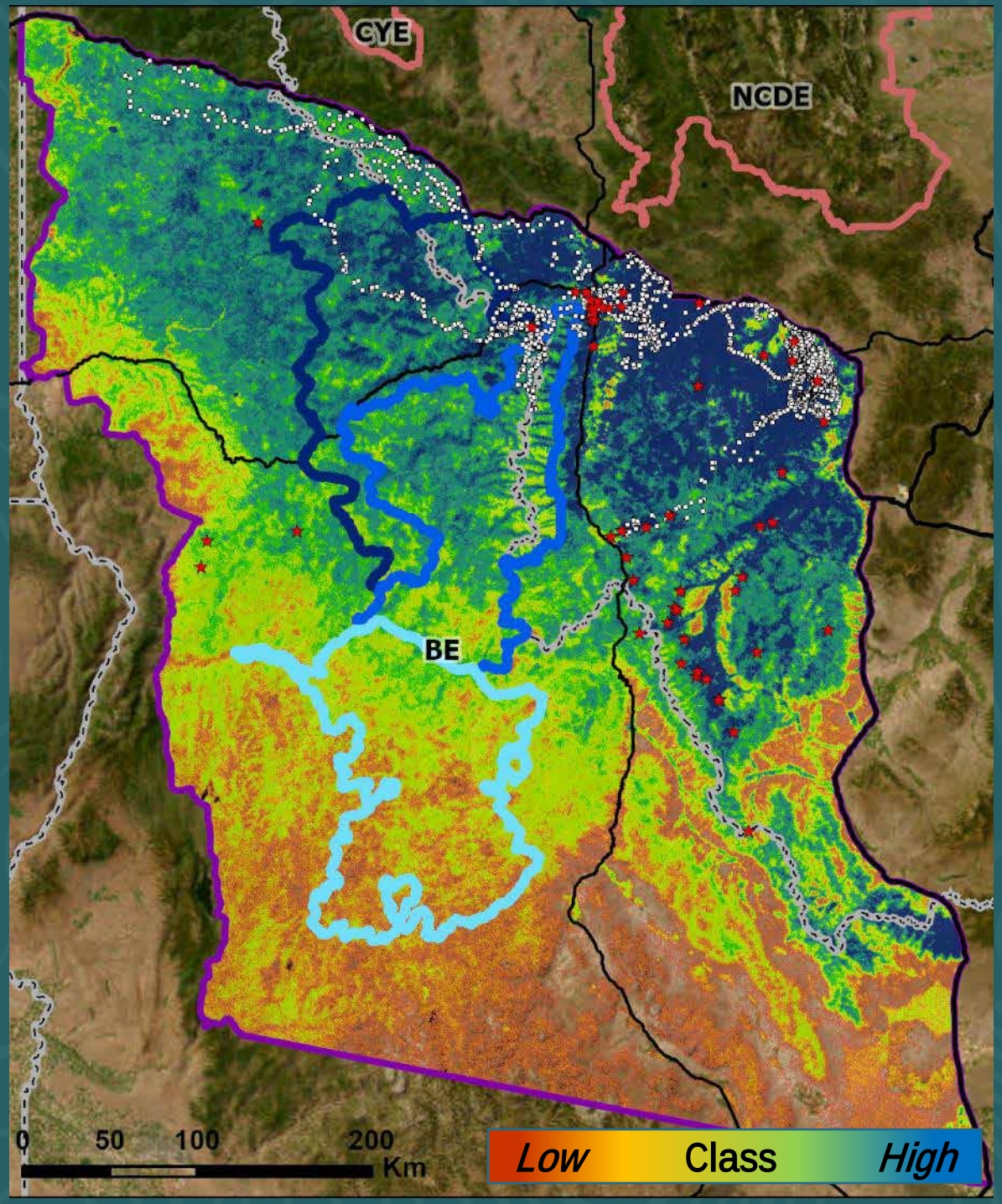


Low Class *High*

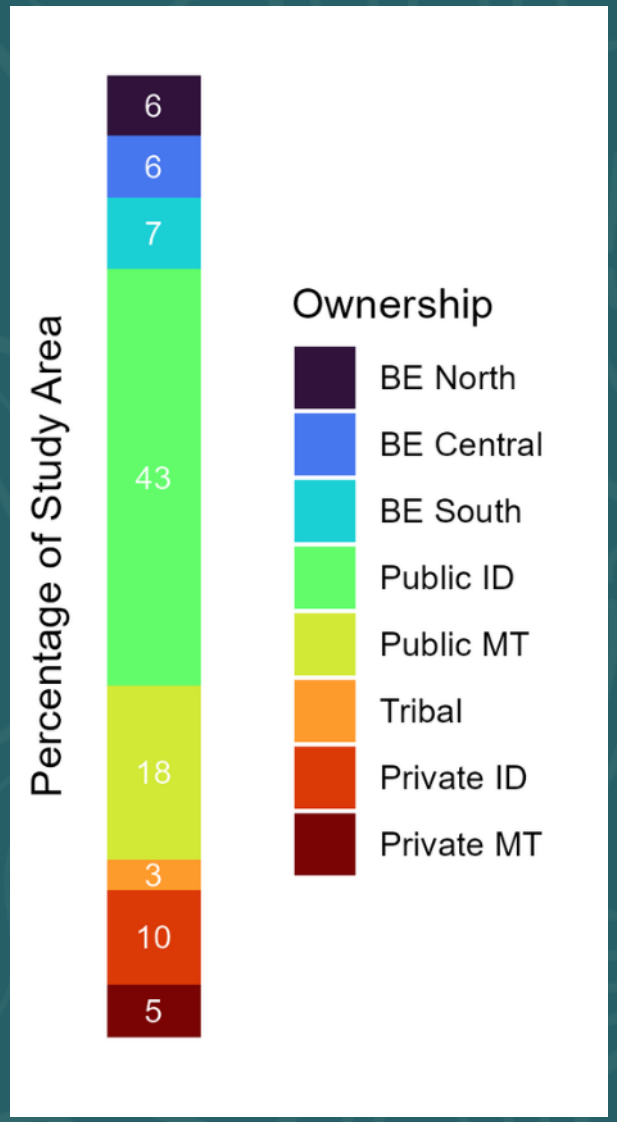


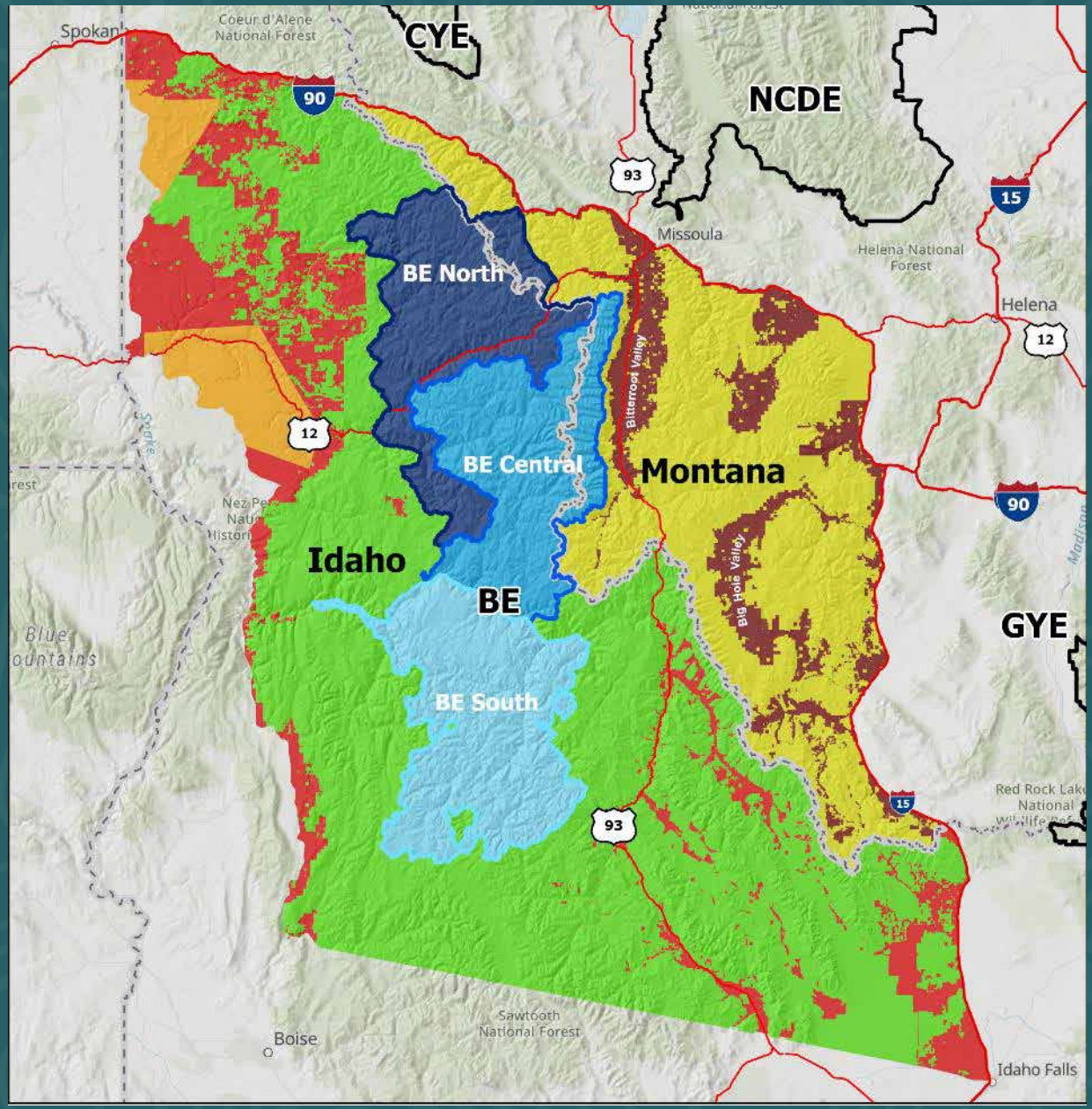
Predictive Power

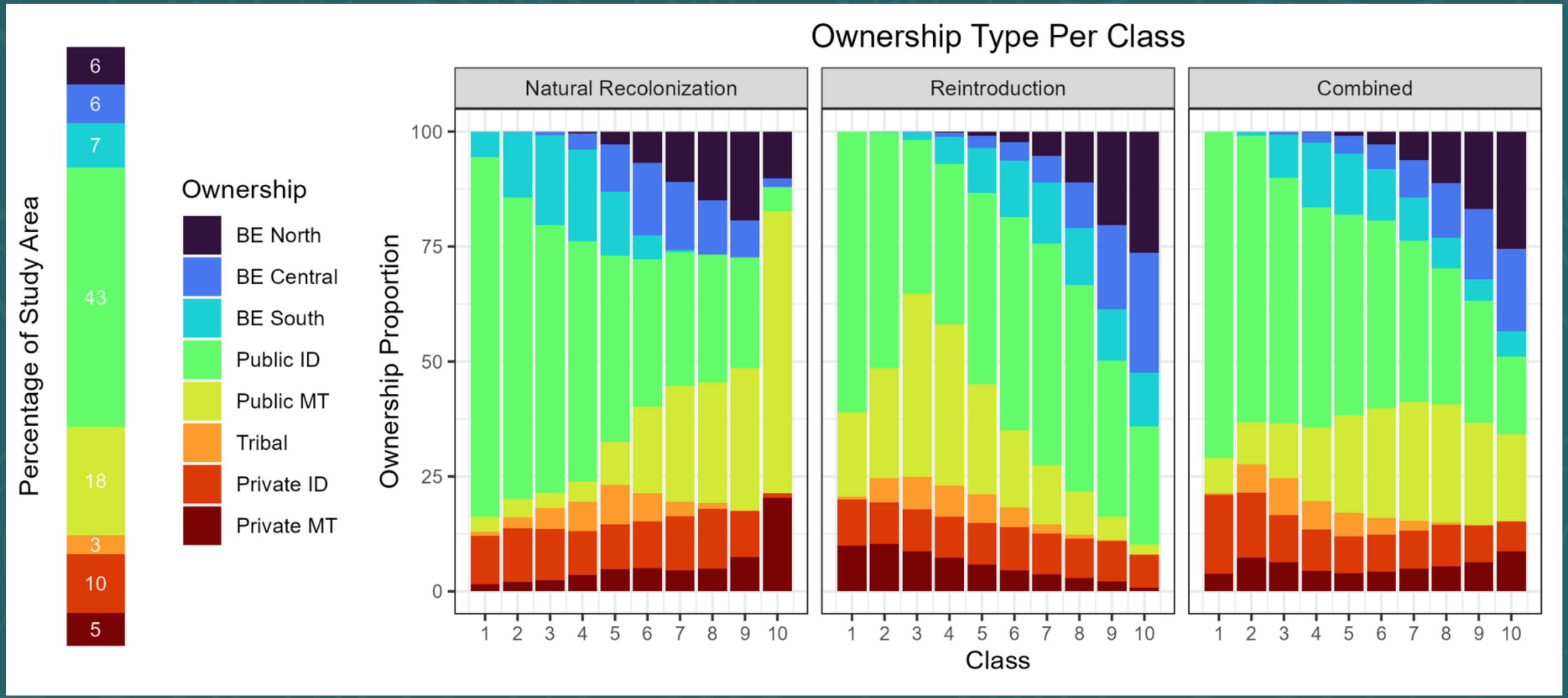
- ★ **63 Outliers: 2010 – 2023**
  - Mean class 9.1
  - 52.4% of outliers in top class 10
  - 96.8% in top 5 classes

- **6 GPS-collared bears: 2014 – 2023**
  - Mean class 9.6
  - 79% of locations in top class 10
  - 99.8% in top 5 classes

463 F locations,
6348 M locations







Application

- **Decision-making, e.g.,**
  - Conservation strategies
  - Habitat management
  - Monitoring design

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RESEARCH ARTICLE

Predicting future grizzly bear habitat use in the Bitterroot Ecosystem under recolonization and reintroduction scenarios

Sarah N. Sells, Cecily M. Costello

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Abstract
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Abstract

Many conservation actions must be implemented with limited data. This is especially true when planning recovery efforts for extirpated populations, such as grizzly bears (*Ursus arctos*) within the Bitterroot Ecosystem (BE), where strategies for reestablishing a resident population are being evaluated. Here, we applied individual-based movement models developed for a nearby grizzly bear population to predict habitat use in and near the BE, under scenarios of natural recolonization, reintroduction, and a combination. All simulations predicted that habitat use by grizzly bears would be higher in the northern half of the study area. Under the natural recolonization scenario, use was concentrated in Montana, but became more uniform across the northern BE in Idaho over time. Use was more concentrated in east-central Idaho under the reintroduction scenario. Assuming that natural recolonization continues even if bears are reintroduced, use remained widespread across the northern half of the BE and surrounding areas. Predicted habitat maps for the natural recolonization scenario aligned well with outlier and GPS collar data available for grizzly bears in the study area, with Spearman rank correlations of ≥0.93 and mean class values of ≥9.1 (where class 10 was the highest relative predicted use; each class 1–10 represented 10% of the landscape). In total, 52.4% of outlier locations and 79% of GPS collar locations were in class 10 in our predicted habitat maps for natural recolonization. Simulated grizzly bears selected habitats over a much larger landscape than the BE itself under all scenarios, including multiple-use and private lands, similar to existing populations that have expanded beyond recovery zones. This highlights the importance of recognizing and planning for the role of private lands in recovery efforts, including understanding resources needed to prevent and respond to human-grizzly bear conflict and maintain public acceptance of grizzly bears over a large landscape.

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Grizzly Bear Space Use in the US Northern Rocky Mountains

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Dates

Publication Date : 2023-06-30
Start Date : 2003-05-01
End Date : 2020-07-15

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Sarah N. Sells, and Cecily M. Costello, 20230630, Grizzly Bear Space Use in the US Northern Rocky Mountains: https://doi.org/10.5066/P91WUO8I.

Summary

Over the past two centuries, persecution and habitat loss caused grizzly bears (*Ursus arctos*) to decline from a population of approximately 50,000 individuals to only 6 fragmented populations within the contiguous United States. In recent decades, these populations have increased and expanded in size and range due to collaborative conservation efforts and protections under the Endangered Species Act. Today, population estimates exceed 1000 animals each in the Northern Continental Divide Ecosystem (NCDE) and Greater Yellowstone Ecosystem (GYE). The Selkirk Ecosystem (SE) has approximately 50 grizzly bears, and augmentations into the Cabinet-Yaak Ecosystem (CYE) helped boost the population to an estimated 50 – 60 animals. To date, the Bitterroot (BE) and North Cascades Ecosystems (NCE) lack any known permanent residents. Eventual connectivity between populations is a conservation goal, as is establishment of populations in currently unoccupied recovery areas. An understanding of habitat selection by grizzly bears within existing populations is crucial for predicting potential linkage routes and suitable habitat. A

Map »

Spatial Services

Communities

umt.edu/coop-unit/sellslab

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